Macroeconomic modeling in India

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Purpose of Modeling

• Governments should have a macro-consistent framework to target some of the core macroeconomic variables (GDP, inflation, CAD, etc) as well as the development goals (poverty, hunger, education...)

• The targets set are for short term, medium term and long term but more importantly policy simulations for alternative policy options

• While Central Bank looks for short-term (forecasts) and medium term behaviour, the Ministry of Finance focuses on medium and long term (forecasts and policy simulations).

• Erstwhile Planning Commission focused on long term goals, -not clear what the NITI Aayog (Commission) would look for.

• Perhaps in the present setting, long term (development) goals could be left to sub-national governments.
Roles of institutions in India

- Erstwhile Planning Commission was on the forefront in developing macro models
- Macro models were used extensively in most of the Five Year Plans (until recently by the 12th Plan)
- While GDP forecasts become crucial for MoF’s budget making process, inflation forecasts becomes crucial for Central Bank’s monetary policy framework.
- Each institution had their own macro models (some are in public domain)
- Inflation and GDP forecasts for every two months for Central Bank while GDP forecast for quarterly as well as annual for Ministry of Finance
- Planning Models generate GDP forecasts for achieving long development goals
- Emphasis is more on use of macroeconometric as well as time series models
Role of Think-tanks

- In India, the research on macroeconomic models are initially started in the Planning Commission with some collaboration with Indian Statistical Institute.
- Later, the research has expanded with some individual initiation (mostly by students of LR Klein and Jan Tinbergen) as well as at the institute level.
- ICSSR was the first to support institutionalisation of a macro model at Delhi School under the leadership of Prof AL Nagar.
- IEG, DSE, RBI, ISI, and NCAER were at the forefront in the 70s and 80s.
- Later NIPFP and IGIDR have been recognised as Modeling Centers for generating alternative simulations for planning purpose.
- Most of the models in India followed Klein-Goldberger tradition.
- A few simulation models were constructed following CGE tradition –this is largely due to lack of database.
- Few models focused on Leontief tradition (role of Input-Output Research Association is crucial, which is in GIPE).
Historical Background

• As the Planning Commission was the major client, the evolution of macro models in the Commission have coincided with the data availability, theoretical frameworks, as well as software.

• First and Second Plans started with simple Harrod-Domar model and with closed economy character (KN Raj - PC Mahalanobis).

• Later, it had incorporated trade and BOP only after the 1970s oil crisis. Inflation has also brought into centre-stage of modeling (Robert Eckaus)

• With the publication of I-O tables for India, 1980s have also seen spurt of CGE models (Hiren Sarkar-Lance Taylor)

• With the availability of long time series data in 1980s large struturesal models were built (Krishnamurthy – Pandit)

• With major reforms in 1991, macroeconometric models have also adopted broad and highly disaggregated inter-sectoral linkages
Historical Background

• Lawarence Klein’s Project LINK had a significant impact on the Indian macro modeling effort (through his students)

• With the institutional support from ICSSR, PC, RBI, and other research institutes, modeling effort pick-up substantially. By now more than 60 models are built over the period.

• Krishnamurty describes the past of Macro modeling effort in India in five phases

  – First Phase: Ph.d disserations (largely contributed in highlighting data limitations, sectoral empirical studies, and, hence, small, simple and text bookish
Historical Background

– **Second Phase**: focussed on sectoral issues such as prices, investments, integrating real with monetary and foreign trade, estimation of capacity utilisation. Focussed more on policy analysis by including dynamics in the macro behaviour.

– **Third phase**: Similar to second phase but with larger size (more than 300 equations) and better disaggregated; address macroeconomic adjustment; twin deficit issues.

– **Fourth phase**: models for new policy regimes and address the question of ‘what if’ policy issues, endogenise structural shifts, large in size, clearly address macro trade-offs.

– **Fifth phase**: High frequency models (quarterly, monthly), depend on data driven models (VAR, ARIMA), introduce non-linearities, core-satellite models, sub-national models...models for data consistency.
In the words of LR Klein...

- Many fine examples of econometric model building, some of a pioneering nature, have been completed for India but none has, up to this point, been regularly maintained...Models go out of date fast. Data bases get revised, new kinds of economic problems come to the fore; and sometimes behaviour changes. A model must be continually administered and kept up to date in order to remain useful...India appears to be in need of a serious model building effort, drawing on the best econometric talent, and designed to function as an ongoing effort, over many years, turning out rolling forecasts every month or two on the most refined time period possible – probably annually at the present time.
Recent models

• NIPFP Macro Model (annual model)
  – Used for revising the FRBM road map during the 13th Finance Commission (argued that fiscal consolidation could lead to higher growth)
  – Used for estimating size of various fiscal multipliers (with the help of satellite model)
  – Impact of rise in international oil prices were analysed and suggested ways for pass-through
  – Disaggregated the export block to see the trade-off between CAD and growth
  – Worked out the possibility of achieving double-digit growth during 12th Plan

• India-LINK model (quarterly model)
  – First quarterly model for India
  – Mainly used for forecasting
  – Introduces some nonlinearities (ex: between public expenditure and private investment)
Impact of Oil Price shock and oil subsidy reduction: The Three Channels
The exogenous and policy determined variables are denoted in upper case. To obtain the multipliers, shocks are given to policy variables (indicated in italics bold underlined) and the impact traced through the system.
Sub-model for external block

Current Account

Merchandise trade

Exports $f(\bar{a}_t, \bar{y}_t^w, REER)$

Imports $f(\bar{a}_t, \bar{y}_t^w, REER)$

Oil Imports $f(e_t, P_t^o, Y_t)$

Gold $f(\bar{P}_t^{GL}, Y_t)$

Imports (net of oil and gold) $f(e_t, Y_t, \bar{a}_t)$

Net Services exports $f(\bar{Y}_t^a, X, REER)$

Exchange rate $f(\bar{a}_t, B_t^T, Central Bank Intervention)$

Invisibles

FDI $f(\text{Relative GDP growth, ER, Demography, Fiscal Deficit, Governance, Openness})$

Foreign Capital

Loans $f(\bar{l}_t - i_t^e, \text{ER Volatility, Credit Rating})$

Investment income $f(\text{Net debt & equity liabilities})$

Capital Account

FPI $f(Y_t, Y_t^{US}, \text{Domestic and US stock returns, U.S. interest rate, ER movts, Credit Rating})$
Flowchart 1: Impact of a shock to OTHER REVENUE EXPENDITURE (EXOGENOUS) on real output, prices, fiscal deficit and government liabilities. OTHER REVENUE EXPENDITURE is obtained from combined government’s total revenue expenditure after netting out transfers and interest payments.
Flowchart 2: Impact of a shock to government's CAPITAL EXPENDITURE (EXOGENOUS) on real output (in the present period and the next period), prices, fiscal deficit and government liabilities.
Impact of subsidy reduction

Growth

Inflation

Revenue Deficit

Fiscal deficit
Fiscal Multipliers

Expenditure Multipliers without any constraint on fiscal variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Impact</th>
</tr>
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<tbody>
<tr>
<td>Capital expenditure</td>
<td>2.45</td>
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<tr>
<td>Revenue Expenditure</td>
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</tr>
<tr>
<td>Transfer Payments</td>
<td>0.98</td>
</tr>
<tr>
<td>Other Revenue Expenditure</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Expenditure Multipliers with Restriction on Fiscal Deficit

<table>
<thead>
<tr>
<th>Variable</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital expenditure</td>
<td>1.99</td>
</tr>
<tr>
<td>Revenue Expenditure</td>
<td>negative</td>
</tr>
</tbody>
</table>
**Validation – another way**

- **Forbes** Magazine in February 23, 2010 issue says,
  - “After the collapse of Lehman Brothers in September 2008, every successive month brought bad news for the world economy. The ...(XXX) forecasts reflected that GDP growth rate got revised from 9.4 percent in September 2008 to 8.2 percent in November and 6.5 percent in April 2009. The Indian economy actually grew by 6.7 percent that year (08-09) and to be fair to.. (XXX) most other forecasters also got it wrong. One notable exception is the 7 percent estimate …based on the India-LINK macro-econometric model”.

- “The most pessimistic forecast is from Delhi School of Economics, which itself is at 7%....” … the then Finance Minister, in *Hindustan Times*, 30th September, 2008

- GDP forecast of 5.9% for 2012-13 released on 30th July 2012 (UNESCAP conf) (highlighted by *Business Today* in March, 2013 issue, while commenting on forecasting in an uncertain environment)
Macroeconomic modelling and SDGs

• Past experience with modelling MDGs is far from satisfactory
• Not much discussion on SDGs at the moment
• Overall, there is less interest in the long term policy analysis
• However, there is increased focus on the medium term fiscal frameworks both at national and sub-national levels
• SDGs have serious long term implications on growth and human development.
• There is a need for focusing on long term analysis that incorporates productivity and long term trade-offs
• Focus also need to be on the data bases, which is the weakest in the Asia Pacific region
• More sectoral models (consistent with each SDGs) need to be developed instead of focusing all in one large economy wide model
• Health, education and climate change need special focus (atleast for India). They need to be modelled separately
• The modelling exercise needs to link the goals with ways through which revenues can be mobilised.
Thank you